Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

1
Ag84L
Cop. 2

486

LIBRARY
FEB 3 - 1961

the

SUGAR BEET NEMATODE

and its control

LEAFLET NO 486 • U S. DEPARTMENT OF AGRICULTURE

THE SUGAR BEET NEMATODE AND ITS CONTROL

By A. Morgan Golden and Edsel C. Jorgenson, nematologists, Crops Research Division, Agricultural Research Service

The sugar beet nematode [1] stunts or kills sugar beet plants by attacking the roots. Infested spots in fields are conspicuous on hot days; tops of beets growing there wilt more readily than the tops of beets growing on uninfested soil.

Where fields are severely infested, many of the young beets wilt and die just after thinning.

In 1960 this nematode was known to occur in 15 of the beet-producing States: Arizona, California, Colorado, Idaho, Kansas, Michigan, Montana, Nebraska, North Dakota, Oregon, South Dakota, Utah, Washington, Wisconsin, and Wyoming.

No commercial varieties of sugar beets are resistant to the sugar beet nematode, and infestations cannot be eradicated. After the pest is established in a field, the farmer's best defense is the use of crop rotations or soil fumigation to reduce nematode damage. Early planting also is helpful.

HOST PLANTS

This nematode attacks many crops besides sugar beets. Host plants include broccoli, brussels sprouts, cabbage, cauliflower, Chinese cabbage, collards, kale, mangel wurzel, radish, rape, rhubarb, spinach, Swiss chard, table beet, tomato, and turnip.

Many weeds are host plants. Among them are mustards, lambsquarters, sowbane, black nightshade, saltbush, knotweed, dock, pigweed, purslane, shepherdspurse, New Zealand spinach, chickweek, and wild radish.

HOW IT LIVES

Nematodes overwinter on the soil as eggs contained in cysts. In the spring, larvae hatch from the eggs and enter the roots, where they feed. They pass through three molts before becoming adults.

Adult male nematodes are active eelworms. They leave the roots of the host plant and enter the soil.

As the females grow, they break through the root tissue, but remain attached to the roots. At this stage they are white lemon-shaped bodies about the size of a pinhead.

After the females are fertilized by the males, they produce 100 to 600 eggs. About one-third of the eggs are deposited before the females die. The rest of the eggs remain in the bodies, which become brown cysts.

[1] *Heterodera schactii* Schmidt.

Detecting Nematode Infestation

Nematode injury in beet fields sometimes is masked by other diseases that attack the nematode-weakened plants. When this happens, these diseases may be blamed for poor yields, though the primary cause is nematode injury to the roots.

Other conditions may produce an appearance similar to that caused by the sugar beet nematode. Alkali spots in the soil, excessive moisture, dry spots, and attacks of the root-knot nematode and the garden centipede all may cause injury that is confused with sugar beet nematode injury.

If nematodes are present, they usually can be seen attached to the roots of young beets or other host plants that are carefully removed from the soil. If you are in doubt as to the presence of nematodes, have a laboratory analysis made of a soil sample from suspected areas. You can have the analysis made at your State agricultural experiment station, or the sugar company fieldman may do it for you.

BN—10616—X

Nematode-infested sugar beet. The small white bodies on the root are female nematodes. (Actual size.)

The eggs that were deposited by the females soon hatch into larvae. Those in the cysts, however, remain dormant through the winter.

Larvae from the deposited eggs start a repetition of the cycle. They attack host plants and mature; the adults reproduce. The number of generations each year ranges from one or two in the northernmost beet-producing States to five or more in southern California.

Unless host plants are present after the cysts have overwintered, most of the eggs in the cysts remain dormant. A few of the eggs hatch, but the larvae soon die. Each year, a few more of the eggs hatch. But some eggs remain in the soil for more than 5 years.

When host plants are grown in infested soil, the remaining eggs are stimulated to hatch.

SPREAD

Natural migration of nematodes carries them only a few feet each season. Transfer of cysts or infested soil to new areas is responsible for the rapid spread of infestations.

Probably the greatest single source of new infestations has been the dump dirt from sugar factories. When sugar beets arrive at the factory, they are cleaned on dump screens. If they are infested with nematodes, bits of soil that cling to the screen contaminate the soil removed from nematode-free beets that are subsequently cleaned on the same screen.

After the beets are cleaned, the farmer is responsible for disposing of the dump dirt.

Formerly, this dirt was returned to the beet fields, and nematode larvae and eggs were introduced into fields that had been free of nematodes.

Now that farmers realize the danger of spreading infestations by this practice, they generally dispose of dump dirt in waste corners or use it to fill holes or swampy places.

Once introduced, nematodes can spread rapidly through a field. Farm implements—especially cultivators, levelers, and harrows—may carry particles of nematode-contaminated soil from infested spots in the field and deposit them in noninfested areas.

Livestock crossing wet fields may pick up cysts on their feet and carry them to noninfested areas.

Irrigation water and drainage water may pick up larvae and cysts and scatter them.

Damage to the crop does not become noticeable until about 4 years after the nematode is introduced. By that time the infestation generally has spread far beyond the area of visible damage.

BN—10615—X

Dump dirt from a beet-sugar factory was unloaded here. Nematodes in the dirt started an infestation.

BN–10634

From a small infested spot in the field, nematodes were distributed up and down the rows by cultivation and by irrigation water. Leveling and harrowing spread the nematodes across the field.

CONTROL

To control damage from the sugar beet nematode—

- Prevent spread of nematodes into noninfested areas.
- Use a crop rotation designed to decrease the nematode population.
- Use nematocides, if practical.
- Plant as early as possible and encourage early growth of the beets by maintaining a high level of soil fertility.

Protecting Noninfested Areas

To protect noninfested areas from nematode invasion, be sure that no soil is brought into the fields from other areas.

If only small areas in your field show signs of nematode damage, you may be able to keep the infestations from spreading by planting these areas to a nonhost crop. The noninfested parts of the field then can be used for beets or other crops. Ask your sugar company fieldman about the advisability of following this plan.

Alfalfa and pasture crops are best for this type of planting; they offer less chance for the infestation to spread than do cultivated crops.

When seeding small infested areas with a nonhost crop, seed a plot that extends 2 to 3 rods past the apparent edge of the infestation. Nematodes always are distributed in the soil farther than injury to the beet crop indicates.

Crop Rotations

Nematodes multiply so rapidly on good crops of beets that a light initial infestation often becomes heavy by the end of the season. For this reason, do not attempt to grow beets 2 years in succession on fields that have been even lightly infested.

The number of sugar beet nematodes in a field is reduced when no host plants are allowed to grow there. If the field is planted to nonhost crops long enough, the

nematode population can be reduced sufficiently for a satisfactory crop of sugar beets to be grown.

Length of Rotation

To determine the length of the rotation, consider the severity of the initial infestation.

In fields that have never showed signs of nematodes, assume that nematodes are present. Use a 3-year rotation—2 years of nonhost crops, 1 year of sugar beets. If cysts should be introduced into the field, this rotation will greatly retard buildup of the nematodes.

If nematode injury is visible in the field but is restricted to a few small spots, use a rotation that allows 3 years between beet crops.

If infested spots are large enough to cause a noticeable reduction in crop yield, use a rotation in which the period between beet crops is at least 4 years and preferably 5 years.

Caution: Eradicate all weeds and volunteer beets; if they are allowed to grow, they defeat the purpose of the rotation.

Crops for Rotations

Ask your county agricultural agent, your State agricultural experiment station, or the sugar company fieldman to help you plan a rotation to reduce nematode damage. The following crops are popular for these rotations:

Alfalfa.—Alfalfa is often used in long-term rotations. A thick stand is essential for nematode reduction; weeds often grow between alfalfa plants when the stand is thin and the weeds may be hosts for the sugar beet nematode.

Alfalfa usually begins to thin out after 4 or 5 years. If this happens before it is time to plant beets, replace alfalfa with another crop.

Following alfalfa with another crop is a good practice even if the alfalfa stand does not thin out. A good seedbed often is difficult to prepare on land that has just been in alfalfa. Potatoes, beans, peas, or small grains can follow alfalfa; they leave the soil in good condition for the crop of beets that follows.

Clovers.—Clovers fit in well for short rotations on fields that are slightly or moderately infested with the sugar beet nematode. They also can be used for longer rotations on soils where alfalfa does not grow well.

Beans.—In the beet- and bean-producing areas of California, one or two crops of beans often are grown at the end of 3- or 4-year rotations. Beans leave the soil in good condition for seeding beets.

Peas.—Wherever they are grown commercially, peas fit well in nematode-reducing rotations. Peas usually are harvested early. The land then can be fallowed for the rest of the season, which allows weeds to be controlled easily. The land then is in good condition for beets the next season.

Potatoes.—Potatoes are probably the most popular cultivated crop for rotations. They may be used in any of the short rotations. They are especially suitable in long rotations following alfalfa. After a crop of potatoes, the soil is in excellent tilth and usually is high in residual fertility.

Corn.—Corn is a good crop for any rotation. If it is grown just before sugar beets, however, the coarse stubble often makes drilling and cultivating difficult.

Truck or Garden Crops.—Because of the high soil fertility maintained in truck gardening, many of these crops are excellent in rotations on nematode-infested land. Good garden crops are onions, melons, celery, lettuce, car-

rots, garlic, and asparagus. Do not grow nematode-host plants; they defeat your rotation.

Small Grains.—Oats, barley, and wheat can be included in the rotation. Very often, however, lambsquarters, mustards, and other weed hosts of the sugar beet nematode are found in small-grain stands. If the field is clean of weeds, these grains are satisfactory. The field should be fertilized liberally with barnyard manure or commercial fertilizers after grain crops are grown.

Where they are adapted, cotton, soybeans, and sorghum can be used in rotations.

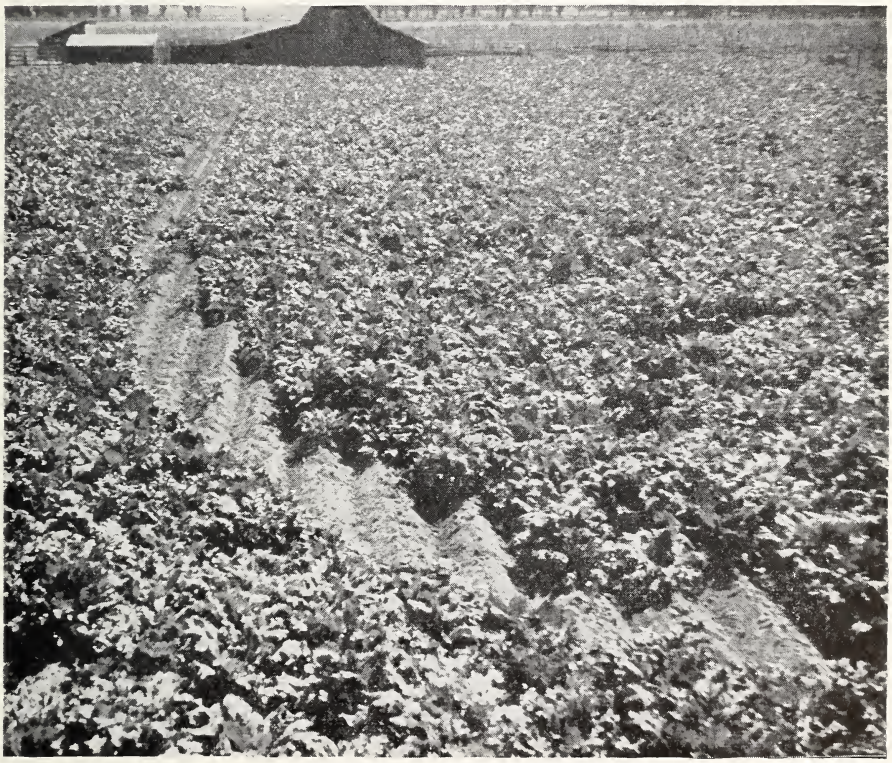
Do not plant other host crops (see p. 2) unless they are to take the place of beets in the rotation.

Nematocides

Nematocides (soil fumigants) can kill enough nematodes to allow a satisfactory crop of sugar beets to be grown.

Nematocides are expensive. They are profitable to use only if the land is heavily infested with nematodes or if beets must be grown more often than is possible with crop rotations. They work best when good farming practices are followed.

Only one crop of beets should be grown for each application of nematocide. When nematocides are used at economical rates, they do not kill all the nematodes. The nematode population increases rapidly during the season that beets are



BN—10617—X

Sugar beet crop planted after the field was fumigated. The small bare strip across the center was not fumigated.

growing. By the end of the season, the nematode infestation may be as severe as it was before fumigation. If a second crop of beets is planted, it almost certainly will be damaged severely.

Among the best of the nematocides for soil fumigation are those that contain dichloropropene as the principal ingredient. Dichloropropene nematocides are applied by tractor-mounted equipment at a depth of about 8 inches in plowed soil.

These nematocides are most effective on light soils. They often are not satisfactory on clay loams or peat soils.

Because nematocides are also toxic to plants, they should be applied at least 2 weeks before the beet crop is planted. This allows time for the nematocide to become harmless before seed is placed in the treated soil.

The soil temperature should be at least 50° at a depth of 6 inches before fumigants are applied. In some areas, the soil normally does not warm to this temperature as early as 2 weeks before planting time. Under these conditions, the best time to apply the material is in the fall that precedes planting.

For best results with dichloropropene, the soil should be neither very wet nor very dry; a soil moisture content that is best for planting also is best for fumigating.

Exact application rates for fumigants cannot be given because of variations in soil conditions and in formulations of commercial nematocides. Ask your county agricultural agent or your State agricultural experiment station to recommend the kind and amount of nematocide for you to use and the method of application best suited for your area.

CAUTION: If mishandled or misused, nematocides can be dangerous to the user and harmful to crops. Read the container label carefully. Follow all directions and heed all precautions on the label.

Encouraging Early Growth

For maximum yields of sugar beets on nematode-infested land, crop must make immediate, thrifty growth from the beginning of the season. A small number of nematodes attacking the young beets can check their growth and seriously reduce the yield.

High soil fertility favors the production of a successful beet crop even on land that is free of nematodes. On nematode-infested land, it is a primary requirement for satisfactory yield.

Ask your county agricultural agent or your State agricultural experiment station to recommend fertilized formulations and rates of application for your crop.

Beets can germinate and grow at temperatures that are too cold for nematode activity. Plant beets as early as the season will permit.

Early-planted beets become established sooner and are better able to withstand nematode attack than are late-planted beets. Early planting is advisable even after a crop-rotation period; holdover nematodes may be numerous enough to check the growth of late-planted beets.

This publication supersedes Farmers' Bulletin 2054,
"Control of the Sugar Beet Nematode."

Washington, D.C. Issued January 1961

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington 25, D.C. - Price 5 cents